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Corn Earworm Control Study

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Abstract
Earworm control is of paramount importance in the production of fresh-market sweet corn. To produce the "clean" or "worm-free" ears required by consumers, growers frequently apply four to six insecticide sprays during the critical silking period of ear development. Recently, there have been reports of control failures due to corn earworm populations developing resistance to the commonly used pyrethroid class insecticides. Thus, we need to look at corn earworm control strategies and new approaches. Our objective in this study was to evaluate the effectiveness of conventional and experimental insecticides. New, non-pyrethroid insecticides tested in this evaluation are Belt from Bayer, Coragen from Dupont, and Radiant from Dow. We also included a Bt hybrid, Attribute BC 0805, for comparison with insecticide treatments.

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Introduction

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Materials and Methods

Planting. The trial was planted with a John Deere 7000 corn planter on June 30, 2008.

Plot Design. A randomized complete block design with three replications was used. Plots consisted of three rows 25 ft long spaced 30 in. apart. After emergence plots were thinned to a uniform population of 28,000/acre.

Fertility and Irrigation. Water was applied as needed by center pivot irrigation system to supplement rainfall. Fertilizer was applied preplant incorporated at rate of 60 lb/acre nitrogen (N) and 100 lb/acre potassium (K_2O). After corn emergence, an additional 60 lb/acre nitrogen (UAN) was applied through the irrigation system.

Weed Control. Dual II Magnum, Atrazine 4L, and Callisto herbicides were applied crop preemergence.

Treatments. Insecticide treatments were started on August 17 (spray 1) when corn was at the row tassel stage of development and ears were starting to show silk emergence. Five more spray applications were made on a three to four day schedule (August 20, 24, 27, 29, and September 1) to keep emerging silk protected. Insecticides were applied with a backpack CO_2 pressurized sprayer with two nozzle boom aimed at ear region of corn plant.

Results and Discussion

Seed of Providence, a conventional sweet corn hybrid, and Attribute BC 0805, an insect resistant Bt hybrid, were planted on June 30 so ears would be silking during late August when peak corn earworm activity occurred. On September 15, twenty marketable-sized ears from each plot were collected and carefully husked to count worms and ascertain worm damage to kernels. See Table 1 for treatment descriptions and Table 2 for treatment results. Worm pressure was high and conditions good for evaluating earworm control treatments. More than 90% of the ears examined from Treatment 3 (control, conventional hybrid, no insecticide) were infested with worms. The majority of larvae were identified as corn earworms but a few European corn borer and fall armyworm were also found. Sevin XLR, an older general-use carbamate insecticide, resulted in poor worm control at the rate and timing used in this study. Only 37% of the ears were found to be worm-free (Table 2). However, the pyrethroid insecticide Treatments 2, 5, 6, 8, 11, and 12 provided excellent earworm control with ratings ranging from 97% to 100% worm-free ears (Table 2). Based on these results it is unlikely

that the corn earworm population infesting the ears during this particular evaluation possessed a significant level of pyrethroid resistance. The exception in the pyrethroid class was Treatment 10 (Baythroid), which resulted in more medium and large worms in the ear and damaged kernels at harvest than the other pyerthroid treatments.

Of particular interest in this study was the performance of the new, non-pyrethroid, insecticides Belt (Treatment 9), Coragen (Treatment 7 and 12), and Radiant (Treatment 8). Results were promising with all treatments including these products performing well. Please note that Coragen is not labeled for use on sweet corn at this time but registration is expected in the future. Belt and Radiant have been labeled for use on sweet corn but have label restrictions on amount of product applied per season and number of consecutive applications—so read labels before use.

This study also included two treatments using the Bt hybrid BC 0805. Treatment 1 consisted of BC 0805 by itself with no insecticide application while Treatment 2 added two sprays of Brigade insecticide during early silking. Both treatments provided acceptable worm control but the addition of two insecticide applications at early silking decreased the number of small worms found in ear tips at harvest. The number of large worms or level of kernel damage observed in either treatment was not statistically different from the best insecticide treatments indicating that the use of a Bt hybrid can be an effective means of controlling earworms.

Table 1. Treatment descriptions and application schedule.

	Hybrid	Treatment (active ingredient)	Insecticide application timing*
1	BC 0805	Bt hybrid	No insecticide spray
2	BC 0805	Bt hybrid, Brigade - 6.4 oz/A (bifenthrin)	Spray 1 and 2
3	Providence	Conventional hybrid	Control - no insecticide spray
4	Providence	Sevin XLR - 1.5 qt/A (carbaryl)	Spray 1,2,3,4,5,6
5	Providence	Mustang Max - 4.0 oz/A (zeta-cypermethrin)	Spray 1,2,3,4,5,6
6	Providence	Hero - 4.4 oz/A (bifenthrin+zeta-cypermethrin)	Spray 1,2,3,4,5,6
7	Providence	Coragen - 5.0 oz/A (rynaxypyr)	Spray 1,2,3,4,5,6
8	Providence	Radiant SC - 6 oz/A (spinetoram)	Spray 1,2, 4, 5 (Radiant)
		Hero - 10 oz/A (bifenthrin+zeta-cypermethrin)	Spray 3 & 6 (Hero)
9	Providence	Belt - (3.0 oz/A (flubendiamide)	Spray 1,2,3,4,5,6
10	Providence	Baythroid - 2.8 oz/A (beta-cyfluthrin)	Spray 1,2,3,4,5,6
11	Providence	Mustang Max - 4.0 oz/A (zeta-cypermethrin) +	
		Lannate - 24 oz/A (methomyl) (tank mix)	Spray 1,2,3,4,5,6
12	Providence	Coragen - 5 oz/A (rynaxypyr)	Spray 1,3,5 (Coragen)
		Hero - 10 oz/A (bifenthrin+zeta-cypermethrin)	Spray 2, 4, 6 (Hero)

*Spray 1, August 17; Spray 2, August 20; Spray 3, August 24; Spray 4, August 27; Spray 5, August 29; Spray 6, September 1.

Table 2. Insecticide treatment ratings of % control, mean number of worms, and worm-damaged kernels per ear.

Treatment	% Control (worm-free ears)	Number worms/ear small + medium + large*	Number worms/ear medium + large	Number of worm-damaged kernels/ear
11. Mustang Max + Lannate	100	0.00	0.00	0.0
8. Radiant/Hero	100	0.00	0.00	0.2
12. Coragen/Hero	98	0.02	0.02	0.2
5. Mustang Max	98	0.05	0.02	0.3
6. Hero	98	0.04	0.02	0.4
2. BC 0805 (Bt hybrid) + Brigade	97	0.05	0.05	0.2
9. Belt	95	0.07	0.05	0.3
7. Coragen	93	0.10	0.07	0.7
1. BC 0805 (Bt)	93	0.24	0.08	0.4
10. Baythoid	80	0.20	0.20	1.7
4. Sevin XLR	37	0.84	0.70	5.7
3. Control	8	1.85	1.68	15.7
LSD 5%	6	0.09	0.10	1.6

*small worm = less than ¼ in. long, medium worm = ¼ in. to ½ in. long, large worm = greater than ½ in. long